

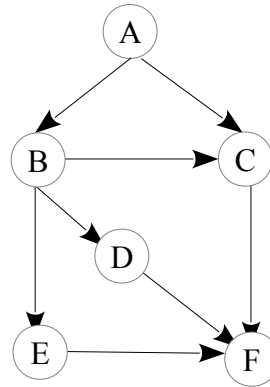
1. Find odd-man out, mention why: [1 mark]
AUTOMOBILE, EDUCATION, EVALUATION, PRECAUTION, TRANSFORMATION
2. Given D, I matrices and Shapes, how did you find out the following precisely? [3 marks]
 - a. Pointers p and q are pointing to the same node.
 - b. Given a rooted DAG, if p is an ancestor of q.
 - c. Given a rooted DAG, r is a common ancestor of p and q.
3. Show an example to illustrate that Ghiya-Hendren's shape analysis tracks the shape reachable from a pointer and not the actual shape of the data structure. [3 marks]
4. For the following program, compute the forward slice for $\langle x, 2 \rangle$. [3 marks]

```

1 main() {
2   int x = 0;
3   int n = 1;
4   int a = 2;
5   int i = 0;

6   if (n > 0) {
7     for (; i < n; ++i) {
8       a = i * i;
9       if (a < 100) {
10        x += a;
11      } else {
12        x -= a;
13      }
14    }
15  }
16  printf("%d\n", x);
17 }

```



5. Find an instrumentation across the edges of the following CFG such that different acyclic paths have a unique number between 0..P-1 where P is the number of paths. A is the start node and F is the end node. [2 marks]
6. For the following code, write down the inequations in $Ax \leq B$ matrix form for checking array out-of-bounds vulnerability. [4 marks]

```

char *a = malloc(M);
for (i = x; i < 20; ++i)
  a[2*i - 3] += a[i + 1];

```

7. fwrite and fprintf are two functions from C library for writing to a file stream. Their signatures are given below:


```

size_t fwrite(const void *ptr, size_t size, size_t nmemb, FILE *stream);
int fprintf(FILE *stream, const char *format, ...);

```

 The two functions require file stream parameter at different indices in the argument list. Imagine students writing programs with both fwrite and fprintf, and making mistakes in passing the file pointer as the first argument of fwrite or as the last argument of fprintf. Design an analysis to catch such mistakes in the input programs. Your answer should talk about not only the approach, but also the analysis formally and completely. [4 marks]